

Beyond Schelling and Axelrod: Computational models of Ethnocentrism and Diversity

Manchester Metropolitan University
June 7th – June 8th 2017

www.davidhales.com/ethnosim2017

Workshop Programme

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Overview

Theme

Ethnocentrism, a positive orientation towards those with the same ethnicity and a negative one towards others, is widely observed in human societies. Several (computational agent-based) social simulation models show how interactions between individuals emerge aspects of ethnocentrism such as in-group bias based on ethnic markers (Hammond & Axelrod 2006); local cultural homogeneity combined with global polarisation (Axelrod 1997); and racial segregation (Schelling 1971). These models have influenced on-going research that inherits similar frameworks and assumptions.

The workshop will spotlight on-going work influenced by, or in response to, these modelling directions in addition to critical position statements and critiques of the assumptions that such models embody, as well as relevant empirical studies.

References:

- Axelrod, R. (1997) The dissemination of culture - A model with local convergence and global polarization. *Journal of Conflict Resolution*, 4(2):203-226.
- Hammond, R.A. & Axelrod, R. (2006). The evolution of ethnocentrism. *Journal of Conflict Resolution*, 50(6):926-936.
- Schelling, T.C. (1971). Dynamic models of segregation. *Journal of Mathematical Sociology*, 1:143-186.

Format

The workshop comprises 12 presentations and two one hour panel discussions over two half days (Wednesday June 7th 12:00pm-5:30pm and Thursday June 8th 8:30am-1pm). There will be plenty of time for questions and discussion. For further details see the Workshop Timetable, Talk Details, Panel Sessions and Short Biography sections listed in this programme.

Organisation

- Bruce Edmonds, Centre for Policy Modelling, Manchester Metropolitan University (bruce@edmonds.name).
- Laurence Lessard-Phillips, Institute for Research into Superdiversity, University of Birmingham (L.Lessard-Phillips@bham.ac.uk).
- David Hales, Centre for Policy Modelling, Manchester Metropolitan University (dave@davidhales.com).

Workshop Timetable

	<p style="text-align: center;"><i>Beyond Schelling and Axelrod:</i></p> <p style="text-align: center;"><i>Computational Models of Ethnocentrism and Diversity</i></p> <p style="text-align: center;">The Business School & Student Hub Building, All Saints Campus, Manchester Metropolitan University, Oxford Road, Manchester M15 6BH, UK.</p>
	<p>Day 1: Wednesday, June 7th 2017 (Room 5.02)</p>
12:00	Arrival / registration / lunch (lunch provided in room)
12:45	<i>Welcome and Introduction</i> Bruce Edmonds & Laurence Lesard-Phillips & David Hales
13:00	<i>Modelling ethnonationalist radicalization: On the effectiveness of nationalist ideologies.</i> Martin Neumann
13:30	<i>Understanding the impact of residential segregation on the emergence of polarized attitudes towards ethnic minorities.</i> Thomas Feliciani
14:00	<i>An Agent-based Modeling Approach to Predicting Effects of Open Enrollment School Choice Policies on Racial Integration in District Schools</i> Matt Kasman
14:30	<i>Disruptive Norms - Assessing the impact of ethnic minority immigration on non-immigrant voter turnout using a complex model.</i> Thomas Loughran
15:00	Coffee break
15:30	<i>Immigration, social networks and the emergence of ethnic segmentation in low-skilled labour markets.</i> Huw Vasey
16:00	<i>Hammond and Axelrod's model is not useful for studying ethnocentrism.</i> Fredrik Jansson
16:30	Panel 1: <i>What do our models really tell us and how do we "sell" them?</i> Fredrik Jansson, Laurence Lesard-Phillips, Edmund Chattoe-Brown, Bruce Edmonds. Chair: David Hales
17:30	Workshop ends for the day
19:00	Social Dinner: Umani at 147-153 Oxford Rd, Manchester M1 7EE.

Day 2: Thursday, June 8th 2017 (Room 5.05)

08:30	Arrival / coffee
09:00	<i>Schelling models of Immigration: Parameters and Sensitivities.</i> Linda Urselmans
09:30	<i>An Agent-Based model of interaction between immigrants and a host population: self-organized and regulated adaptation.</i> Laurence Lessard-Philips
10:00	<i>Community diversity and inter-ethnic marriage: an agent-based approach to a complex social phenomenon.</i> Ruth Meyer
10:30	Coffee break
11:00	<i>An Agent-Based Modelling Study of Persistent Segregation in Metropolitan Cape Town.</i> Cobus Van Rooyen
11:20	<i>Endogenous Segregation Dynamics and Housing Market Interactions: An ABM approach.</i> Benjamin Bonakdar
11:40	<i>What Actually Stops Us Going “Beyond” Schelling and Axelrod: Three Challenges.</i> Edmund Chattoe-Brown
12:00	Panel 2: <i>The “new nationalisms” and ethical dimensions.</i> Martin Neumann, Benjamin Bonakdar, David Hales. Chair: Laurence Lessard-Philips
13:00	Workshop ends

Talk Details

Modelling ethnonationalist radicalization: On the effectiveness of nationalist ideologies.

Martin Neumann. Jacobs University Bremen, Germany.

Short abstract: This talk describes an agent-based simulation model of ethnonationalist radicalization. Emphasis is put on the recursive feedback between political actors and their constituencies. While evidence is based on the former Yugoslavia the model describes an abstract mechanism of an interlocking of political and cultural dynamics that might cover a class of cases. The results offer theoretical insights by revealing mechanisms that lead to radicalization. These can be found within politics as well as among the population: Between conflicting ethnically homogeneous regions, opposing radicalization forces fuel a radicalization spiral. These processes are driven by political influences. Challenging the theory that diversity breeds conflict, this suggests that multiethnic regions are more capable of withstanding political pressures. This finding supports theories which postulate that contacts improve intergroup relations. However, in the simulation multiethnic societies are vulnerable to violence, driven by the local population.

Understanding the impact of residential segregation on the emergence of polarized attitudes towards ethnic minorities.

Thomas Feliciani¹, Andreas Flache¹, Jochem Tolsma², Michael Mas¹

1. Dept. of Sociology, University of Groningen, Groningen, The Netherlands;

2. Dept. of Sociology, Radboud University, Nijmegen, The Netherlands.

Short abstract: Agent-based models of social influence help us understand how attitudes can polarize in a population divided into two demographic groups. Here we focus on two prominent models of opinion polarization, the negative influence model and the persuasive argument model. Previous work has investigated how the two models make conflicting predictions about the direction and the strength of the effect that the spatial segregation of the groups has on the emergence of attitude polarization. Following this line of research, we test the robustness of previous findings, and investigate which segregation patterns are more likely to contribute to the emergence of polarized attitudes according to the two models. We do so by imposing a spatial setting that is much more realistic than assumed by previous studies, that of real cities, and assuming a multi-faceted definition of individual attributes. Individual attributes comprise some important predictors of attitudes towards ethnic minorities: ethnicity, age and household income. Population density and spatial distribution of demographic attributes are going to be calibrated on very fine-grained census data on Dutch cities, which provide a rich variety of segregation patterns.

An Agent-based Modeling Approach to Predicting Effects of Open Enrollment School Choice Policies on Racial Integration in District Schools

Matt Kasman. The Brookings Institution, Washington, DC, USA.

Short abstract: Open enrollment school choice policies allow (and sometimes require) families to make initial school selections rather than assigning students to schools by default. Many have argued that open enrollment policies have the potential to increase racial integration within district schools by creating opportunities for families in overwhelmingly impoverished, minority neighborhoods to access schools other than highly segregated neighborhood schools. Unfortunately, in practice the impact of open enrollment policies on diversity has been underwhelming, with many schools in large urban school districts that have implemented these policies still serving a substantial majority of students from a single racial background. In order to explain how the details of these policies influence their outcomes and might be altered to improve racial integration in public schools, I construct agent-based models of school enrollment in a large, urban school district using open enrollment. Using these models, I find that increasing participation in the school choice process would have the largest positive impact on racial integration in the district and increasing the priority given to residential proximity during student assignment would decrease integration.

Disruptive Norms - Assessing the impact of ethnic minority immigration on non-immigrant voter turnout using a complex model.

Thomas Loughran¹, Edward Fieldhouse¹, Laurence Lesard-Phillips², Lee Bentley³

1. The University of Manchester, UK;

2. University of Birmingham, UK;

3. University of Liverpool, UK.

Short abstract: There is a substantial, but contradictory, sociological and political science literature related to the contextual effects of increased ethnic diversity on socio-political behaviour. Much empirical work in this area has concentrated on providing testable measures that can contribute to the academic debate between contact theory and conflict theory regarding the impact of aggregate area level ethnic diversity on individual level attitudes and behaviours. The paper will present findings from a number of simulations utilising the voter model of social processes connected to turnout. The findings show that increased levels of immigration lead to an increased level of turnout among the non-immigrant majority population over time but that this effect is mitigated by the level of civic duty among the immigrant population.

Immigration, social networks and the emergence of ethnic segmentation in low-skilled labour markets.

Huw Vasey¹, Ruth Meyer²

1. School of Arts, Languages and Cultures, University of Manchester, Manchester, UK

2. Centre for Policy Modelling, Manchester Metropolitan University, UK.

Short abstract: It has been widely reported that post-World War II immigration to more developed countries has gone hand-in-hand with the development of ethnically segmented labour markets, particularly in low-skill roles where entry requirements are minimal (Bauder, 2006; Piore, 1979; Sassen, 1996). Whilst numerous theories have been forwarded as to why such situations occur, it has remained difficult to empirically test such conceptualisations because of the numerous interacting processes which produce segmentation in the labour market. In this paper, we investigate the processes of ethnic segmentation in low-skilled labour markets, where referral hiring is the norm, with particular reference to the role of ethnically homogenous social networks and forms of 'conservative' discrimination. We employ an agent-based modelling approach, adapting key elements from Waldinger & Lichter's (2003) widely cited networked explanation of ethnic labour market segmentation in late twentieth-century Los Angeles. Results indicate that ethnically homogenous social networks have the effect of increasing the level of ethnic segmentation within a referral-based labour market, but that these networks also help immigrant populations grow and protect them from the negative impacts of employer discrimination. We conclude that empirically-informed ABMs allow us to provide important insights into the manner and extent in which changes in social conditions may effect group behaviour. Such impacts are not random or occasional, but are tightly related to the non-linear and emergent nature of a multifaceted social system.

Hammond and Axelrod's model is not useful for studying ethnocentrism.

Fredrik Jansson, Centre for the Study of Cultural Evolution, Stockholm University, Sweden.

Short abstract: Hammond and Axelrod's 'ethnocentrism' model was initially published as a model on the armpit effect and inclusive fitness among simple organisms. The same model was later reframed as a model on ethnocentrism among humans, and inspired a branch of research on group discrimination. The question, though, is whether such a reframing is warranted. In short, I will argue that the resulting 'ethnocentrism' is driven by the fact that agents interact mostly with their clones, and group markers work as fairly reliable proxies for identifying nonclones. The applicability to what we know about ethnocentrism should be practically nil, and the model is sensitive to relaxing any of these assumptions. The conclusion is that there is little we can learn about group discrimination from the model in its current form, and attempts at generalisations are likely to fail.

Schelling models of Immigration: Parameters and Sensitivities.

Linda Urselmans. Dept. of Government, University of Essex, UK.

Short abstract: The Schelling model of racial segregation has made a vital contribution to our understanding of how ethnic segregation can occur even if residents of a

neighbourhood are not particularly segregationists. Since its introduction in 1971 the model has become widely used in the field of immigration research. Building on previous iterations of the Schelling model I explore the effect of physical migrants represented as new agents entering the grid. The aim of this adaptation is to model immigration as an external shock to the existing system, rather than treat it as an initial state. The findings indicate that short-term effects of the rate and size migration weigh heavily on agent happiness and segregation behaviour, but that in the long run, population density is the most crucial determinant in model outcomes.

An Agent-Based model of interaction between immigrants and a host population: self-organized and regulated adaptation.

Carlos Lemos¹, Ross Gore², Laurence Lessard-Phillips³, LeRon Shults¹

1. Dept. of Religion, Philosophy and History, Faculty of Humanities and Education, University of Agder, Kristiansand, Norway;

2. Virginia Modeling, Analysis and Simulation Center, Old Dominion University, Norfolk, VA, USA;

3. Institute for Research into Superdiversity, School of Social Policy, University of Birmingham, Birmingham, UK.

Short abstract: We present an ABM of “abstract” type for describing the interactions between a host population and a minority of immigrants, combining ideas from existing Agent-based models of segregation, dissemination of culture and ethnocentrism. The model also takes into account the framework elaborated by Berry (1997) for describing the role played by culture, contact and participation on processes of acculturation. The model entities are agents of a single type, a network between agents, and a “government” modeled as a “proto-agent,” i.e. as a procedure where the user can implement “policies” that affect agents. Agents interact with their network neighbors with a probability that depends on their education, cultural and identity “distance”. During the simulation the model produces a dynamic network of links between the agents. The “government” can then act in several ways, such as varying the probability of immigrants to acquire “security” (e.g. jobs) or lower the cultural barrier. The evolving network is analyzed using network segregation indices and algorithms for detection of social circles in ego networks. These patterns can be discussed under the light of sociological theories, for both “self-organized” and “regulated” interactions.

Community diversity and inter-ethnic marriage: an agent-based approach to a complex social phenomenon.

Huw Vasey¹, Laurence Lessard-Phillips², Ruth Meyer³

1. School of Arts, Languages and Cultures, University of Manchester, Manchester, UK;

2. Institute for Research into Superdiversity, School of Social Policy, University of Birmingham, Birmingham, UK;

3. Centre for Policy Modelling, Manchester Metropolitan University, UK.

Short abstract: Inter-ethnic marriage is both a cause and a consequence of immigrant integration. It is, however, unclear how individual preferences and opportunities for contact may combine to produce the spectrum of rates of inter-ethnic marriage we observe in the

UK and elsewhere. In this presentation we investigate the processes of partnering in diverse communities, focusing on individual preferences, opportunities for contact, and group size to uncover how these may lead to differing rates of inter-ethnic marriage. We employ an agent-based modelling approach, utilising quantitative and qualitative sources from across the social sciences, in order to develop a complex model of emergent processes of differentiation and change in the marriage patterns of ethnic groups in a variety of different spatial settings. Results indicate that, in line with existing evidence, diversity (especially in areas with low ethnic homogeneity) fosters higher rates of inter-ethnic marriage. However, this is strongly mediated by group size, network types, and the extent of search ranges. We conclude that agent-based models allow us to provide important insights into the manner and extent in which changes in certain social conditions may affect group behaviour. Such impacts are not random trends, but are tightly related to the non-linear and emergent nature of a multifaceted social system. By extension, therefore, researchers need to remain willing and able to incorporate an analysis of the complexities of how inter-ethnic marriage rates interact with levels of diversity and social amalgamation, and how these may vary across space and place. In this presentation we shall also discuss on-going extensions to the original model, including modelling migration within small areas, and adapting partner preferences based on social scientific evidence.

An Agent-Based Modelling Study of Persistent Segregation in Metropolitan Cape Town.

Cobus Van Rooyen. Dept. of Geography, Birkbeck, University of London, UK.

Short abstract: The South African city was shaped more by a turbulent political past than by the inherent dynamics of urban growth. The legacy of apartheid was ingrained in the fibre of urban life and more than twenty years after democracy, segregation is persisting in the major cities and emphasizes the substantial influence social and political factors had and still have on the urban development of the South African city. The present research project aims to extend research on the spatial distribution and socio-economic exclusion of the segregated urban areas of South Africa and improve the understanding of the foundations of segregation in the urban environment in the country. The aim is to construct an agent-based model, which will provide for the ability of producing alternative ‘what-if’ scenarios to study the impact of complex dynamical mechanisms on the persistence of racial and socio-economic exclusion in the study area. This will serve as theoretical foundation on which the specification and development of modelling methodology is based for the research study.

Endogenous Segregation Dynamics and Housing Market Interactions: An ABM approach.

Benjamin Bonakdar. Institute for Macroeconomics Ruhr-University Bochum, Germany.

Short abstract: In contrast to previous research, I hypothesize that residential segregation patterns do not only result from an individual’s perception of different ethnicities in a particular neighborhood, but is rather influenced by socioeconomic factors. The underlying assumption here is that the interpretation of Schelling’s statement “being close to people of your own kind” can be extended to the social status of an individual, which is part of the

comparison from oneself to the society and the respective peer group. Accordingly, agents are endowed differently, which leads to the emergence of a system with a higher degree of heterogeneity. In order to analyze these dynamics, I implement an agent-based model with several features, where the decision criterion of moving is connected to housing affordability. The endogenous segregation dynamics get determined by an endogenous tolerance function, a multidimensional dissimilarity index and a happiness function, which serves as determinant for the actual moving decision. Since agents are bound to their individual housing budget, they can only move, if a suitable spot was found. The ability or disability of moving elsewhere might lead to further segregation outcomes and thus, to other incentives for segregation behavior.

What Actually Stops Us Going “Beyond” Schelling and Axelrod: Three Challenges.

Edmund Chattoe-Brown. Dept. of Sociology, University of Leicester, University Road, Leicester, UK.

Short abstract: Agent-Based Modelling finds itself in the unusual position of having a methodology that almost everyone seems to agree on, with examples showing that it works (which, incidentally almost nobody cites) but, at the same time, almost nobody follows. This presentation shows how, in three different ways, this oddity harms the possibility of really going “beyond” Schelling and Axelrod. The first challenge involves “element selection”. How do we decide (and much more importantly how do we justify) the selection of some elements (and, either explicitly or implicitly, the rejection of others) in a particular ABM? The second challenge is dealing with “heaps of models”. Because there currently seems to be no principled basis for element selection, models simply emphasise the interests or disciplinary backgrounds of their designers or evolve until they deliver the “right kind” of answer. The third challenge is that of “research design” and validation. What would it mean to say that we had supported (or failed to support) a particular variant of the Schelling (or Axelrod) models with evidence? I will discuss these challenges and suggest possible solutions.

Panel Sessions

Panels are a good way to stimulate discussion in a structured and open way. There are two panel slots (one at the end of each workshop day). Panel members will be given 5 mins. to state their position / opinion on the panel topics. After this, there will be moderated questions and discussion from the audience.

Panel 1. What do our models really tell us and how do we “sell” them?

Fredrik Jansson, Laurence Lessard-Philips, Edmund Chattoe-Brown, Bruce Edmonds.
Chair: David Hales

Many computational models of ethnocentrism, segregation and related phenomena are highly abstracted. Often they provide an illustration of some general dynamic process. But what can such models say about the real world? More generally how can models productively be applied to policy?

- a. Are abstract models anything more than stories reflecting our own biases and assumptions?
- b. What constitutes “validation” of “Schelling / Axelrod type” models?
- c. How do modellers avoid charges of scientism or naturalistic fallacy?
- d. Is it possible to devise simulation models for policy and if so how can they be presented in a clear and plausible way?

Panel 2. The “new nationalisms” and ethical dimensions

Martin Neumann, Benjamin Bonakdar, David Hales.
Chair: Laurence Lessard-Philips

Nationalisms appear on the rise as faith in globalisation and global institutions wanes. Also extreme ethno-cultural identity politics are emerging in new forms such as identitarianism in Europe and the Alt-Right in the US. Concepts such as ethnocentrism, racism and xenophobia are politically contentious often provoking strong reactions such as anger, fear or denial. New ideas in these areas have ethical and political implications.

- a. Are existing models relevant for explaining the rise of the “new nationalisms” and / or extreme ethno-cultural identity politics?
- b. Is something new happening related to 21st century conditions such as the networked society, identity politics and globalisation that are relevant to these phenomena? If so how can models capture it?
- c. How can social modellers navigate the political and ethical dimensions of their work in a principled way?

Short biographies



Laurence Lessard-Phillips is a Research Fellow at the Institute for Research into Superdiversity, University of Birmingham. She previously worked at the University of Manchester and the Netherlands Interdisciplinary Demographic

Institute. Her research interests include the perceptions, measurement, and dimensionality of immigrant adaptation; ethnic inequalities in education and the labour market; the use of agent-based models related to immigration and diversity; the transnational behaviour across immigrant generations; and social inequalities and social mobility. She is currently leading an ESRC-funded research project investigating the role of family capital on socio-economic and civic-political inclusion in Canada and Britain.



Bruce Edmonds is Professor of Social Simulation and Director of the Centre for Policy Modelling, which has a world-leading reputation in the field of social simulation. His research covers all aspects of how to use computer simulation in order to help

understand social phenomena, especially in complex situations and on policy-relevant issues. He co-edited the first handbook in the field (Edmonds & Meyer 2013) for which a second edition is already scheduled. He instigated and designed the £2.7M UK project on the "Social Complexity of Immigration and Diversity" (SCID). Website: <http://cfpm.org>



David Hales is a computer scientist and visiting academic at the Centre for Policy Modelling in Manchester. He has an interest in cultural evolutionary processes related to groups, networks and cooperation. A specific focus is the self-organising characteristics of simple cultural markers (or tags) that can be observed and imitated. Tag

models have various interpretations applied to them (including, for example, ethnocentrism in the Hammond and Axelrod model). A more general focus is how group properties emerge from individual behaviour and individual behaviour is shaped by, and perpetuates, group properties. Ideas in this realm relate to conceptions of rationality, morality, agency and evolution. Website: <http://www.davidhales.com>



Martin Neumann studied Social Sciences, Mathematics, and Philosophy. He holds a PhD in philosophy with a thesis on the history of probability. After a post doc project about the epistemology of social simulation he joined the project EMIL on simulating norm innovation at the

University of Bayreuth. Subsequently he was assistant professor for sociology at the RWTH Aachen University. There he worked mainly on ethnic conflicts. Then he joined the project GLODERS on the norm regulating

extortion rackets and organized crime at the University of Koblenz. Currently research associate at the Jacobs University Bremen at a project on opinion dynamics and collective decisions.



Thomas Feliciani is a PhD student at the Sociology department of the University of Groningen (the Netherlands). His research interests include social influence, opinion polarization, agent-based modeling, ethnic diversity, and radical-right.



Matt Kasman is a research associate at the Brookings Institution Center on Social Dynamics and Policy. He received his undergraduate degree in Computer Science from Boston University and, after working for software startups that were sold to Microsoft, Google, and Blackbaud,

obtained a Masters in Politics and Education from Columbia University. He received his doctorate in Educational Policy at Stanford University in 2014. His dissertation explores how policy interacts with geography and decision-making to generate patterns in student enrollment over time in a large urban school district. Through both his doctoral research and work at Brookings he has gained extensive experience in applying complex systems approaches to educational policy analysis, public health topics, and biological systems. His current research interests include childhood obesity prevention efforts, food systems, literacy development, social diffusion, school choice, affirmative action in higher education, teacher labor markets, educational equity, tobacco regulatory policy, and adaptive decision-making.



Thomas Loughran. Tom Loughran is a Lecturer in Electoral Politics at the University of Manchester. He completed a PhD analysing the mechanisms through which individuals convert their values into vote preferences in 2016 and was

previously research assistant on the SCID Project in the Cathie Marsh Institute for Social Research at University of Manchester.



Huw Vasey is a Research Associate in the Multilingual Manchester team in the School of Arts, Languages and Cultures, and a member of the Manchester Migration Lab, both at the University of Manchester. He is a social anthropologist and human geographer whose work has focused

on international migration and processes of adaptation and change post-migration, including labour market integration, inter-ethnic marriage and community diversity, and language use and needs in super-diverse cities. This has involved using methods ranging from ethnography to big data analysis, via agent-based

modelling. Huw also has an interest in how complexity theory can be used in developing social science methodologies and social theory. He is currently working on the Multilingual Communities strand of the AHRC funded [Open World Research Initiative](#). Information on previous work is available at <https://manchester.academia.edu/HuwVasey>.



Fredrik Jansson is a research fellow at the Centre for the Study of Cultural Evolution at Stockholm University and a Senior Lecturer at Mälardalen University. He holds degrees in Mathematics, Computer Science and English Language, and has an interest in the mathematical modelling of human behaviour, in particular related to groups, and cultural evolution. The models often incorporate empirical data and are tested through surveys and experiments. Personal website: fredrik.name



Linda Urselmans. My current project involves modelling responses to migration. I am interested in the interaction between migrants and the citizens of the host countries. Building on my previous paper, I am investigating whether positive or negative feedback loops can cause migrants to change. The model builds on theories of social contact and conflict. Especially in the wake of changing sentiments towards migrants in Europe, I plan to validate the model against empirical data. In general, my research focuses on complex adaptive systems (such as social systems) with autonomous agents. I use Agent-based modelling to approach social questions, but not just in Political Science; I'm currently collaborating on a project involving Chimpanzee grooming and how to incorporate field work data in an Agent-Based model. Personal webpage: <http://lurselmans.me/>



Ruth Meyer is a research fellow at the Centre for Policy Modelling, Manchester Metropolitan University. Her research interests include agent-based simulation, spatial modelling and simulation methodologies in general. She has over ten years of experience modelling complex social systems during her PhD at Hamburg University and subsequently at the CPM. She co-edited the handbook on "Simulating Social Complexity" with Bruce Edmonds for Springer in 2013 and is currently working on its second edition. Website: <http://cfpm.org>

Cobus van Rooyen is a PhD Researcher at Birkbeck, University of London and his research concerns the studying of segregation patterns and related dynamics of the City of Cape Town, through the use of agent-based modelling and segregation metrics. His



background is in Urban Planning and Geographic Information Science. He holds a Bachelor's degree (1996-1999) in Town & Regional Planning from the Cape Peninsula University of Technology (formerly Cape Technikon) and a Master's degree (2005-2006) in Geographic Information Science from the University of London. He currently functions as full-time GIS consultant in ADS&T (Aerospace, Defence, Security and Technology) at Atkins Global. Further interests involve the study of complex adaptive systems and the concepts of urban emergence and evolution. Website: <http://www.complexsystemstheory.net>



Benjamin Bonakdar is a PhD student at the Ruhr-University Bochum in Germany and is employed as research assistant at the Institute for Macroeconomics, where the professorship is held by Prof. Dr. Michael Roos. Benjamin's research interests are in the field of complexity and computational macroeconomics, where the interaction of agents and the emergence of macro patterns are of great relevance. For him, interdisciplinary projects stand in focus, for which reason he works on the issue of residential segregation in urban areas in his PhD thesis in order to combine research methods from economics and social science. He familiarized himself with these methods during his Master's program at the University of Nuremberg in Germany, where he attained theoretical knowledge in modern macro- and labor market economics. First applications of these research methods have been conducted in short time positions at the ifo Institute (Munich) and at the Institute for Employment Research (Nuremberg). In his Master's Thesis he analyzed the international spillover effects of the German Hartz reforms in the European Union conducted in a computational model.



Edmund Chattoe-Brown is lecturer in Sociology at University of Leicester. His research deals with decision-making in sociologically important contexts. By contrast, he is also interested in evolutionary theories of change in which practices are selected the social environment rather than chosen by individuals. In support of these interests, he has wide experience in research methods, particularly computer simulation but also qualitative research, social network analysis and experiments. His theoretical and methodological interests have developed in parallel with several empirical case studies on household money management, secondhand markets, adaptation of farming practices, ethnic disadvantage in labour markets and social networks in criminal activity and drug use. <http://www2.le.ac.uk/departments/sociology/people/echattoebrown>

